

SC/BIOL 3380 3.0 Sensory Systems  
Winter, 2024  
(version: Jan 01, 2024)

**Course Description**

This course explores sensory systems in humans, animals and machines, and how they control action, behavior and physiological state. Adopting a comparative approach, we focus on highly specialized sensory systems and unusual, often surprising solutions to sensory challenges.

Three lecture hours. One term. 3.0 credits.

**Prerequisites (strictly enforced)**

BIOL 3060 4.0 or PSYC 2220 3.0

**Course Instructor(s) and Contact Information**

Course Director:

Dr. Niko Troje, [troje@yorku.ca](mailto:troje@yorku.ca)

Department of Biology  
Life Sciences Building,  
Office: 429 B

Office Hours: By appointment

TA: Dova Brenman, [dovab@yorku.ca](mailto:dovab@yorku.ca)

If you contact us by email, please include "BIOL 3380" in the subject line, and your full name and student number in the text of your email.

**Schedule**

Lectures: Tuesdays and Thursdays from 5:30pm – 7:00pm

Classes are applied synchronously, and attendance is required.

## Contents and Evaluation

Week	Topic	Assignment/Marks	Reading
1	Introduction: Jan 8 – 19	Questions 4	Foster, K. W., & Smyth, R. D. (1980) Light antennas in phototactic algae. <i>Microbiological reviews</i> , 44(4), 572-630.
2		<b>Poster</b> 20	
3	Light and eye Jan 22 – Feb 2	Questions 4	Dawkins, R. (1996) <i>Climbing mount improbable</i> . WW Norton & Company. Chapter 5: The forty-fold path to enlightenment.
4		Questions 4	
5	Colour Feb 5 – 16	Questions 4	Stubbs, A. L., & Stubbs, C. W. (2016). Spectral discrimination in color blind animals via chromatic aberration and pupil shape. <i>PNAS</i> , 113(29), 8206-8211.
6		<b>Talk</b> 20	
Reading week from Feb 19 – 23			
7	Hearing Feb 26 – Mar 8	Questions 4	Knudsen, E. I., & Konishi, M. (1979). Mechanisms of sound localization in the barn owl ( <i>Tyto alba</i> ). <i>Journal of Comparative Physiology</i> , 133, 13-21.
8		Questions 4	
9	Echolocation, Polarization vision Mar 11 – 22	Questions 4	Corcoran, A. J. et al. (2009). Tiger moth jams bat sonar. <i>Science</i> , 325(5938), 325-327.
10		<b>Research Proposal</b> 20	Rossel, S., & Wehner, R. (1986). Polarization vision in bees. <i>Nature</i> , 323(6084), 128-131.
11	Depth, distance, shape, Bayes Mar 25 – Apr 5	Questions 4	TBD
12		<b>Final Exam</b> 33	

## Peer-grading

Testing and marking will be distributed over the course.

We use the platform **Kritik** which implements peer-grading. After uploading your assignment (called **Creation** in Kritik language). Once everyone has uploaded their creation, the **Evaluation** stage begins. Your classmates review and grade your creation and you grade theirs. Everything is anonymous. In the last stage, you provide **Feedback** on the evaluation you received. The marks that come out of that process take all three stages into account.

There will be 11 Kritik assignments, one very week, except for the last week. Some assignments are more work and earn you more marks, others are less work and earn you less marks.

- The assignments become active on Friday mornings (the first one on Jan 12).
- Creations are due the following Tuesdays at 4:00 (the first on Jan 16).
- Evaluations are due on Thursdays at 4:00 (the first on Jan 18).

- Evaluations are due on Saturdays at 4:00 (the first on Jan 20).

Deadlines are strict and the same schedule applies to every week. The only exception is week #6 (before reading week). Here, due dates are shifted by one week. The assignment still starts on Friday Feb 16, but the due dates for Creation, Evaluation, and Feedback are Feb 27, Feb 29, and Mar 2, respectively.

Check out this short introduction to Kritik:

<https://www.youtube.com/watch?v=Ri2JE-Xo0rc>

## Missing assignment

With the exception of the final exam, you can miss assignments for whatever reason, and you can also underperform for whatever reason. That is normal. Things happen. They should not happen too often, though. If you miss 20% of the assignment, you can still obtain a 100% mark if you performed perfectly on the rest.

Here is how this is implemented: In theory, you can earn a total of 125 marks in this course (see above: Contents and Evaluation). Each mark equals one percentage point towards your final grade. Of course, there is no grade better than 100%. That means that can miss  $25/125=20\%$  of the assignments without penalty. This accommodation should cover illness and other reasons for absence or missed assignments without having to discuss every single occasion individually.

If you miss the final examination please complete and submit a Deferred Standing Agreement (DSA) form available from the Registrar's website to [troje@yorku.ca](mailto:troje@yorku.ca) (subject: BIOL 3380) together with a letter outlining the reason for missing the exam, within one week of the missed exam.

See "Deferred Standing Guidelines" on the course eClass site for further details:

<https://myacademicrecord.students.yorku.ca/deferred-standing>

If you are approved to write a deferred exam, an in-person final exam will be arranged on campus whenever approval to do so is granted. The format of the deferred final exam may be different from the main exam and might include to write an essay, short answer, multiple choice, or a mix of these options.

## Accommodations

Some of you have obtained academic accommodations from Student Accessibility Services. If that involves addition time for exams, those will be applied in the final exam. All the other assignments are not really time-limited anyway. The Kritik assignments are all scheduled such that you are given multiple days for assignments that should normally not take more than a few hours. Giving extra time won't help you, but it would make the work with the Kritik platform impossible.

For all other accommodation specifics listed in your personal accommodation letter, please contact the course instructor at [troje@yorku.ca](mailto:troje@yorku.ca). As with all other communications, always include "BIOL 3380" in the subject line of your email.

## Important Dates

Reading Week: February 19-25, 2024

Last day of class: April 4

NOTE: For additional important dates such as holidays, refer to the "Important Dates" section of the Registrar's Website at <https://registrar.yorku.ca/enrol/dates/2023-2024/fall-winter>

## Resources

eClass	<p><a href="https://eclass.yorku.ca">https://eclass.yorku.ca</a></p> <p>I will use it as a repository for slides and lecture recordings. I will also use it to send out notices and announcements.</p>
Kritik.io	<p>Kritik is a peer-grading platform that distributes fair and accurate assessments by harnessing collective intelligence to simplify workflows and reduce turnaround time on feedback.</p> <p>Subscription is required. It is free for you (York pays for it). Please watch your email for an invitation to subscribe.</p>

## Learning Outcomes

Upon successful completion of this course, students should be able to:

- Describe the function of the specialized sensory mechanisms (such as visual acuity, eye movements and stereopsis) in humans and how they are used to control action, behavior and physiological state.
- Describe alternative solutions to similar problems in a variety of animals.
- List evolutionary and physical constraints that lead to these solutions.
- Evaluate technical solutions to sensory problems in robotics and automation.
- Explain how sensory processes are integrated into control structures to result in functional systems.
- Read and analyze published, original scientific literature, including experimental data, about specialized sensory systems.
- Extract and communicate key concepts from original, empirical literature both orally and in writing.
- Defend scientific theories related to specialized sensory mechanism with logical reasoning.
- Compare theoretical terms and concepts related to specialized sensory mechanism to the reality of empirical science.

## Course Content

Since everybody has a basic understanding of general sensory physiology from 2<sup>nd</sup> year courses, we will focus in this course on a few select systems that lend themselves to study general principles of sensory systems. We will use them to look in more detail into experimental work in this field and we will read a few original research papers to develop some routine in processing original, scientific research.

The course breaks down in six sections:

1. Introduction
2. Light and Eye
3. Colour vision
4. Hearing
5. Echolocation, polarization vision
6. Depth perception, SDT, Bayesian inference

## Copyright Protection of Course Material

All material associated with this course are the intellectual property of the instructor and/or protected under Canadian Copyright Law.

All material associated with this course, including lecture recordings, activities, quizzes and laboratories, are to be used for personal study purposes only. Unauthorized distribution in any form can lead to a violation under Canadian Copyright Law and/or Academic Misconduct charges under York University Senate Policy. Unauthorized distribution includes sharing and/or uploading of material anywhere and with anyone.

Penalties under Academic Misconduct can include failure in the course, a transcript notation and/or suspension.

## Course Policies

### Missed Assignments or Final Exam:

#### ***Missed Kritik activities***

We will conduct small exercises and activities every two weeks. Some of them will be combined with short group discussions with one or more other students in a Zoom breakout room during class time. After submitting the assignments, you will engage in a peer-grading exercise where you review and mark some assignments from your classmates.

We will have such activities every fourth classes, always at the end of a two-week section. Only five of the six activities will go into your final mark. If you miss one, you don't need to worry. If you miss more, then you accumulate penalty points.

#### ***Missed final exam***

If you miss the final examination please complete and submit a Deferred Standing Agreement (DSA) form available from the Registrar's website to [troje@yorku.ca](mailto:troje@yorku.ca) (subject: BIOL3380) together with a letter outlining the reason for missing the exam, within one week of the missed exam.

See "Deferred Standing Guidelines" on the course eClass site for further details:  
<https://myacademicrecord.students.yorku.ca/deferred-standing>

If you are approved to write a deferred exam, an in-person final exam will be arranged on campus whenever approval to do so is granted. The format of the deferred final exam may be different from the main exam and might include to write an essay, short answer, multiple choice, or a mix of these options.

## University Policies

### Academic Honesty and Integrity

York students are required to maintain the highest standards of academic honesty and they are subject to the Senate Policy on Academic Honesty (<http://secretariat-policies.info.yorku.ca/policies/academic-honesty-senate-policy-on/>). The Policy affirms the responsibility of faculty members to foster acceptable standards of academic conduct and of the student to abide by such standards.

There is also an academic integrity website with comprehensive information about academic honesty and how to find resources at York to help improve students' research and writing skills, and cope with University life. Students are expected to review the materials on the Academic Integrity website at - <http://www.yorku.ca/academicintegrity/>

**Important** A note from the Faculty of Science Committee on Examinations and Academic Standards:

Numerous students in Faculty of Science courses have been charged with academic misconduct when materials they uploaded to third party repository sites (e.g. Course Hero, One Class, etc.) were taken and used by unknown students in later offerings of the course. The Faculty's Committee on

Examinations and Academic Standards (CEAS) found in these cases that the burden of proof in a charge of aiding and abetting had been met, since the uploading students had been found in all cases to be wilfully blind to the reasonable likelihood of supporting plagiarism in this manner. Accordingly, to avoid this risk, students are urged not to upload their work to these sites. Whenever a student submits work obtained through Course Hero or One Class, the submitting student will be charged with plagiarism and the uploading student will be charged with aiding and abetting.

Note also that exams, tests, and other assignments are the copyrighted works of the professor assigning them, whether copyright is overtly claimed or not (i.e. whether the © is used or not). Scanning, sharing, uploading or publishing these documents constitutes copying, which is a breach of Canadian copyright law, and the breach is aggravated when scans are shared or uploaded to third party repository sites.

### **Access/Disability**

York University is committed to principles of respect, inclusion and equality of all persons with disabilities across campus. The University provides services for students with disabilities (including physical, medical, learning and psychiatric disabilities) needing accommodation related to teaching and evaluation methods/materials. These services are made available to students in all Faculties and programs at York University.

Students in need of these services are asked to register with disability services as early as possible to ensure that appropriate academic accommodation can be provided with advance notice. You are encouraged to schedule a time early in the term to meet with each professor to discuss your accommodation needs. Please note that registering with disabilities services and discussing your needs with your professors is necessary to avoid any impediment to receiving the necessary academic accommodations to meet your needs.

Additional information is available at the following websites:

Student Accessibility Services - <https://accessibility.students.yorku.ca>

York Accessibility Hub - <http://accessibilityhub.info.yorku.ca/>

### **Religious Observance Accommodation**

York University is committed to respecting the religious beliefs and practices of all members of the community, and making accommodations for observances of special significance to adherents. Should any of the dates specified in this syllabus for an in-class test or examination pose such a conflict for you, contact the Course Director within the first three weeks of class. Similarly, should an assignment to be completed in a lab, practicum placement, workshop, etc., scheduled later in the term pose such a conflict, contact the Course director immediately. Please note that to arrange an alternative date or time for an examination scheduled in the formal examination periods (December and April/May), students must complete and submit an accommodation request form <https://secure.students.yorku.ca/pdf/religious-accommodation-agreement-final-examinations.pdf> at least 3 weeks before the exam period begins.

### **Student Conduct in Academic Situations**

Students and instructors are expected to maintain a professional relationship characterized by courtesy and mutual respect. Moreover, it is the responsibility of the instructor to maintain an appropriate academic atmosphere in the classroom and other academic settings, and the responsibility of the student to cooperate in that endeavour. Further, the instructor is the best person to decide, in the first instance, whether such an atmosphere is present in the class. The policy and procedures governing disruptive and/or harassing behaviour by students in academic situations is available at - <http://secretariat-policies.info.yorku.ca/policies/disruptive-and-or-harassing-behaviour-in-academic-situations-senate-policy/>